

# **SPECIFICATIONS**

**FLOPPY DISK DRIVE  
MODEL YD-600 SERIES  
(Rev. B)**



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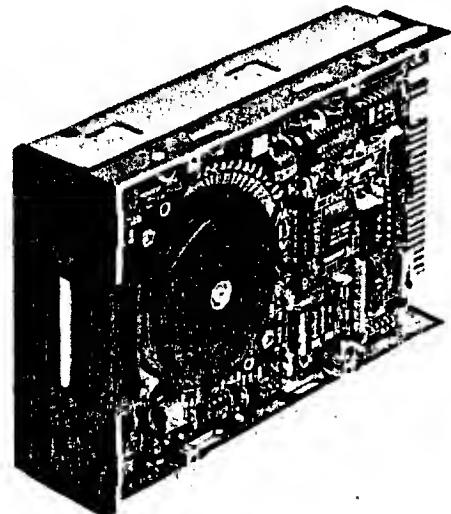
**Y-E DATA**

**Product  
Specifications**

**DOUBLE SIDED 3.5 INCH**

**MICROFLOPPY DISK DRIVES**

**YD-600 series**



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## Preface

This product specification describes the YD-600 Series double sided 3.5 inch microfloppy disk drives.

- (1) In this manual, the term "drive" refers to one of the YD-600 series double sided 3.5 inch microfloppy disk drives. The term "disk" refers to the 3.5 inch microfloppy disk.
- (2) The YD-600 series includes the following drives.

	Card Edge Connector	Pin Connector
67.5 TPI	YD-620	YD-625
135 TPI	YD-640	YD-645

- (3) YD-620/YD-625 denotes the YD-620 and/or the YD-625.  
YD-640/YD-645 denotes the YD-640 and/or the YD-645.
- (4) Pages where the drive specifications differ due to differences in the connector (edge vs. pin) are indicated by notes in brackets [ ].

## Revisions

Month/Year	Revision	Reason for Revision	Revised pages
1/84	REV. A	First Edition	All
11/84	REV. B	Corrections	iv, v, 3-8, 3-10, 6-1, 6-2

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- \* This specification may be revised without prior notice. Make sure to check the revision number when placing an order.
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# **Chapter 1. Introduction**

The YD-600 series double sided 3.5 inch microfloppy disk drives are direct access storage devices developed for ultra-small size, large storage capacity, high reliability and low cost.

The drives in the series utilize a 3.5 inch microfloppy disk with an automatic head access shutter.

## **Key Features of the YD-600 Series Drives include:**

### **(1) Small Size, Large Storage Capacity and Low Power Consumption**

The YD-600 drives offer the same storage capacity as standard 5.25 inch drives (the YD-620/YD-625 gives 0.5 MB and the YD-640/YD-645 1.0 MB) in a package half the size and weight of a 5.25 inch half-height drive. In addition, the YD-600 series drives run at 3 watts, only a third of the power required by 5.25 inch drives.

### **(2) High Reliability**

The YD-600 series drives incorporate an advanced design that uses only half the number of connectors and connected parts of conventional drives. This simplicity of design makes the drives especially suitable for mass production. In addition, the YD-600 series features a ceramic head, direct-drive brushless motor, steel belt head positioning and large scale integrated circuitry which eliminate the need for periodic maintenance.

### **(3) High Speed**

Fast track to track access times are another attractive aspect of the YD-600 series. The YD-620/YD-625 track to track access time is 5 ms, and the YD-640/YD-645 3ms.

### **(4) 5.25 Inch FDD Compatibility**

The YD-600 series drives offer interface signal compatibility with 5.25 inch drives.

### **(5) Improved Operation**

The front push button is even with the front panel surface, allowing more freedom in system design and preventing accidental opening of the drive during operation.

## Chapter 2. Product Specifications

### 2.1 Performance

Item	Single Density	Double Density
<b>Capacity</b>		
● Unformatted	250.0 KBytes	500.0 KBytes
● Formatted		
1) 16 Sectors/Track	163.9 KBytes	327.7 KBytes
2) 9 Sectors/Track	184.3 KBytes	368.6 KBytes
3) 5 Sectors/Track	204.8 KBytes	409.6 KBytes
<b>Recording Density</b>	4324 BPI	8647 BPI
<b>Track Density</b>	67.5 TPI	67.5 TPI
<b>Cylinders</b>	40	40
<b>Tracks</b>	80	80
<b>Encoding Method</b>	FM	MFM
<b>Rotational Speed</b>	300 RPM	300 RPM
<b>Transfer Rate</b>	125 KBits/sec	250 KBits/sec
<b>Latency (Average)</b>	100 ms	100 ms
<b>Access Time</b>		
● Average	96 ms	96 ms
● Track to Track	5 ms	5 ms
● Settling Time	30 ms	30 ms
<b>Motor Start Time</b>	0.4 sec	0.4 sec

**Table 2.1 Performance**  
[YD-620/YD-625]

Item	Single Density	Double Density
<b>Capacity</b>		
● Unformatted	0.5 MBytes	1.0 MBytes
● Formatted		
1) 16 Sectors/Track	327.7 KBytes	655.4 KBytes
2) 9 Sectors/Track	368.6 KBytes	737.3 KBytes
3) 5 Sectors/Track	409.6 KBytes	819.2 KBytes
<b>Recording Density</b>	4358 BPI	8717 BPI
<b>Track Density</b>	135 TPI	135 TPI
<b>Cylinders</b>	80	80
<b>Tracks</b>	160	160
<b>Encoding Method</b>	FM	MFM
<b>Rotational Speed</b>	300 RPM	300 RPM
<b>Transfer Rate</b>	125 KBits/sec	250 KBits/sec
<b>Latency (Average)</b>	100 ms	100 ms
<b>Access Time</b>		
● Average	95 ms	95 ms
● Track to Track	3 ms	3 ms
● Settling Time	15 ms	15 ms
<b>Motor Start Time</b>	0.4 sec	0.4 sec

**Table 2.1 Performance**  
[YD-640/YD-645]

## 2.2 Physical Specifications

DC Power Requirements	Refer to Table 3.16
Power Consumption	3W (TYP)
Environment	
● Operating	Temperature 5°C to 45°C Relative Humidity 20% to 80% Maximum Wet Bulb 29°C
● Non Operating	Temperature -20°C to 60°C Relative Humidity No Condensation
Mechanical Dimensions	Width 101.6 mm (Max) Height 41.3 mm (Max) Depth 152.4 mm (Max)
Weight	0.7 kg (Typ)
Mounting Recommendations	See Figure 6.2

Table 2.2 Physical Specifications

## 2.3 Reliability and Maintenance

MTBF	10,000 Hours
PM (Preventive maintenance)	None
MTTR	30 Minutes
Component Life	5 years or 15,000 hours
Error Rates	
● Soft Errors	1 per $10^9$ bits read
● Hard Errors	1 per $10^{12}$ bits read
● Seek Errors	1 per $10^6$ seek operations

Table 2.3 Reliability

# Chapter 3. Interface

The interface consists of two parts: Signal and Power.

Refer to Fig. 3.10 for all interface connections.

## 3.1 Interface Signals

All interface lines are either TTL or CMOS.

### 3.1.1 Input Signals

The YD-600 drives have the input lines shown below. All lines are active (true) when "Low".

- (1) DRIVE SELECT 0 TO 3
- (2) MOTOR ON
- (3) DIRECTION SELECT
- (4) STEP
- (5) WRITE DATA
- (6) WRITE GATE
- (7) SIDE ONE SELECT
- (8) IN USE

Table 3.1 Input Signals

Input Circuit Electrical Specifications are as shown below.

Inactive	"High" Level	3.5 to 5.25V
Active	"Low" Level	0 to 0.4V
Input Impedance		1K Ohms pulled up to 5V

Table 3.2 Input Circuit Electrical Specifications

#### 3.1.1.1 DRIVE SELECT 0 – 3

Up to four drives can be daisy chained by setting the slide switch on the PWB. By changing DRIVE SELECT 0 to "Low" level, the user can select the drive with the slide switch set at "DS0". The other drives in the chain can be selected in the same way.

#### 3.1.1.2 MOTOR ON

A "Low" active level on this line starts the drive motor. A one second delay after this line goes "Low" is required before the drive becomes ready.

#### 3.1.1.3 DIRECTION SELECT

This line determines the direction of read/write head movement when the STEP line is pulsed.

"High" level	Out (away from the center of the disk)
"Low" level	In (toward the center of the disk)

Table 3.3 DIRECTION SELECT

Any change on this line must be made at least 1  $\mu$ sec before the leading edge of the step pulse, or at least 1  $\mu$ sec after the trailing edge of the step pulse. Refer to Figure 3.13 for timing.

### 3.1.1.4 STEP

This line causes the read/write heads to move in the direction defined by the DIRECTION SELECT signal line.

The access motion is initiated on each "Low" to "High" level transition, that is, with the trailing edge of the signal pulse.

In a seek operation, an 18 (35) ms delay following the last STEP pulse is required to cover the track to track and settling time before any read or write operation can be initiated.

The same length delay is required before a new seek operation is initiated after the previous seek operation is completed.

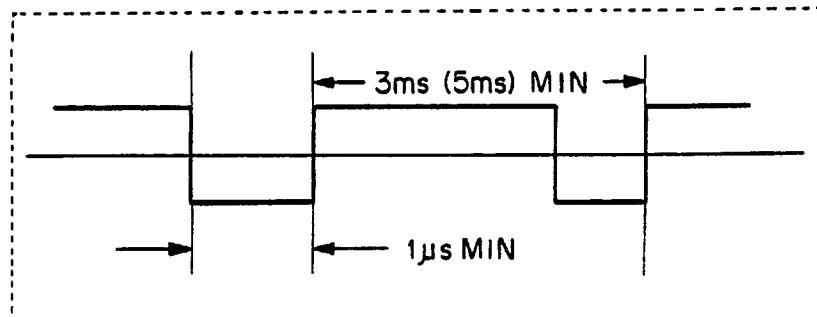
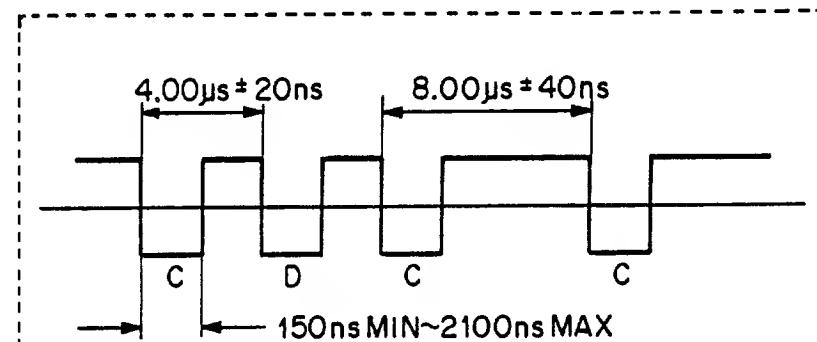


Fig. 3.4 STEP  
[( ) indicates value for the YD-620/YD-625]

### 3.1.1.5 WRITE DATA

The WRITE DATA line provides the data to be written on the disk. Each transition from "High" to "Low" active level on the line causes the current through the read/write heads to be reversed, thereby writing a data bit. This line is enabled when the WRITE GATE line is "Low" active. Refer to Fig. 3.15 for timing information.

#### FM Recording



#### MFM Recording

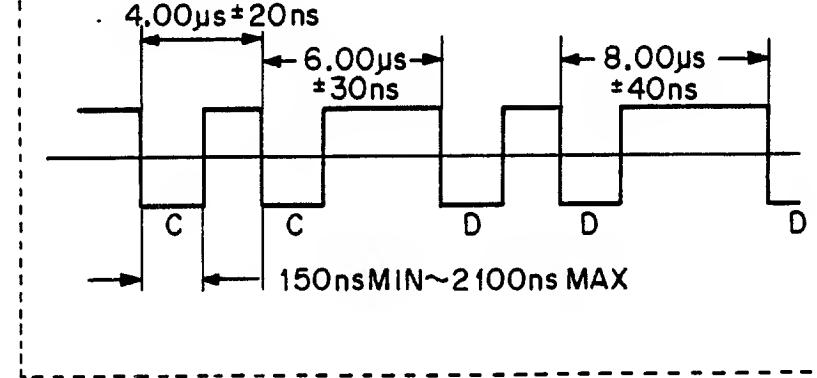


Fig. 3.5 WRITE DATA

### 3.1.1.6 WRITE GATE

A "Low" active level on this line enables writing of Write Data to the disk. A "High" inactive level enables read data logic and stepping logic. Refer to Figs. 3.14 and 3.15 for timing information. Deactivation of DRIVE SELECT and MOTOR ON, changing SIDE SELECT and/or activation of STEP must be delayed at least 1100  $\mu$ sec following deactivation of the WRITE GATE because the erase head remains active during this period.

### 3.1.1.7 SIDE ONE SELECT

This line defines which side of a two sided disk will be used for reading or writing.

A "High" inactive level on this line selects the read/write head on the side 0 surface of the disk. A "Low" active level on this line selects the read/write head on the side 1 surface. When switching heads, a 100  $\mu$ sec delay is required before any read or write operation can be initiated.

### 3.1.1.8 IN USE

This signal controls the LED indicator on the front bezel.

Refer to 7.2, IN USE Function, for details.

## 3.1.2 Output signals

Output signals are as shown below. All lines are active when the DRIVE SELECT signal is "Low".

- (1) TRACK 00
- (2) INDEX
- (3) WRITE PROTECT
- (4) READY
- (5) READ DATA

Table 3.6 Output Signals

The output circuit lines have the following electrical specifications.

Refer to Fig. 3.11 for details.

"High" level	Inactive	Collector cut off current: 250 $\mu$ A Max
"Low" level	Active	0 to 0.4V Maximum sink current: 40 mA

Table 3.7 Output Circuit Electrical Specifications

### 3.1.2.1 TRACK 00

A "Low" active level on this line indicates that the read/write heads are positioned at track 00 (the outermost track). The line goes "High" inactive when the heads are positioned elsewhere.

### 3.1.2.2 INDEX

The drive provides one index pulse for each revolution of the disk. Normally this signal is at "High" level, and makes the transition to "Low" level when a pulse is generated. The controller should detect INDEX with the leading edge of the transition rather than with the signal level.

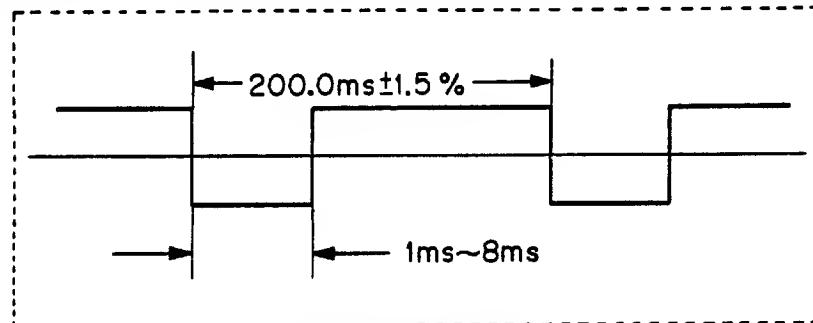


Figure 3.8 INDEX

### 3.1.2.3 WRITE PROTECT

A "Low" active level on this line indicates that a disk with a write protect notch is loaded. During normal operation the drive will prevent writing when a protected disk has been inserted.

### 3.1.2.4 READY

This line goes "Low" only when all of the following conditions are satisfied.

- (1) Power of +5V and +12V DC is supplied to the drive.
- (2) A disk is correctly inserted.
- (3) Four index pulses have been counted following the start of disk rotation.

### 3.1.2.5 READ DATA

This line provides the "raw data" (clock and data together) as detected by the drive electronics. Normally this signal is "High" level and becomes "Low" level for each flux reversal. The transition from "High" to "Low" level should be used for separation of clock bits from data bits. The leading edge of each bit pulse can be  $\pm 700$  ns from its nominal position. Timing characteristics are shown in Fig. 3.14.

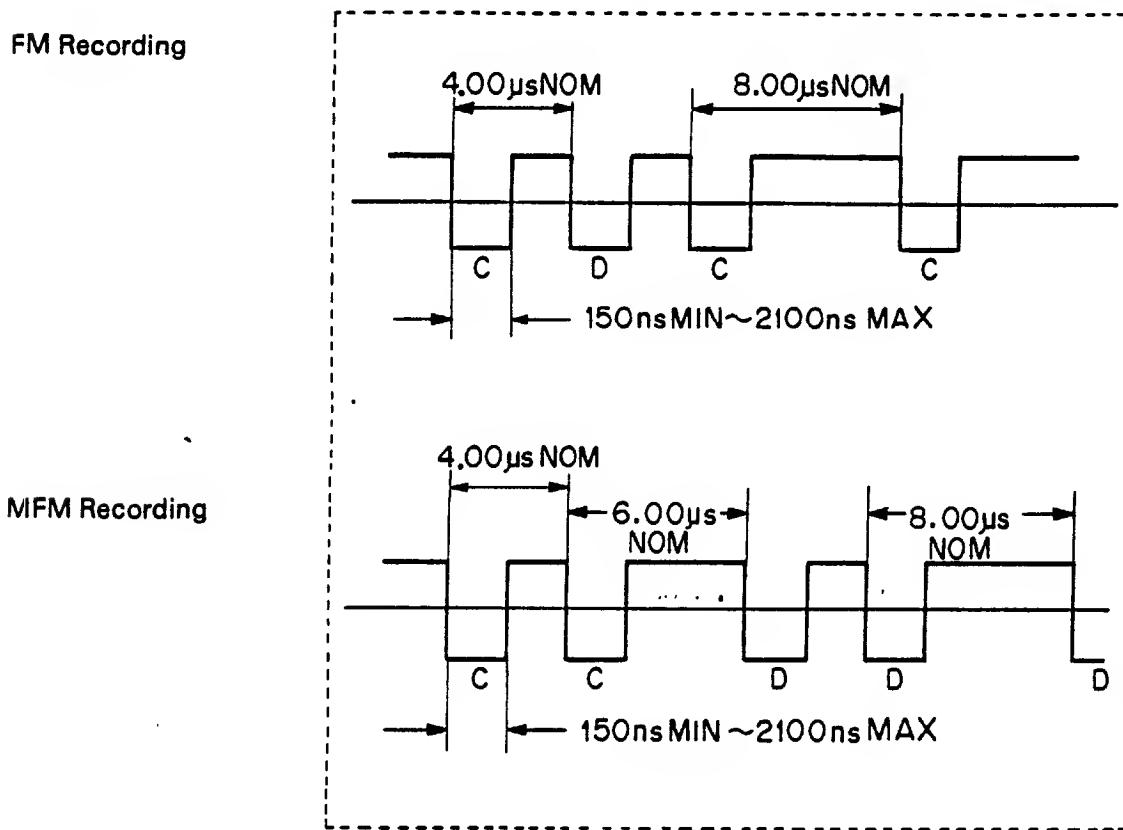
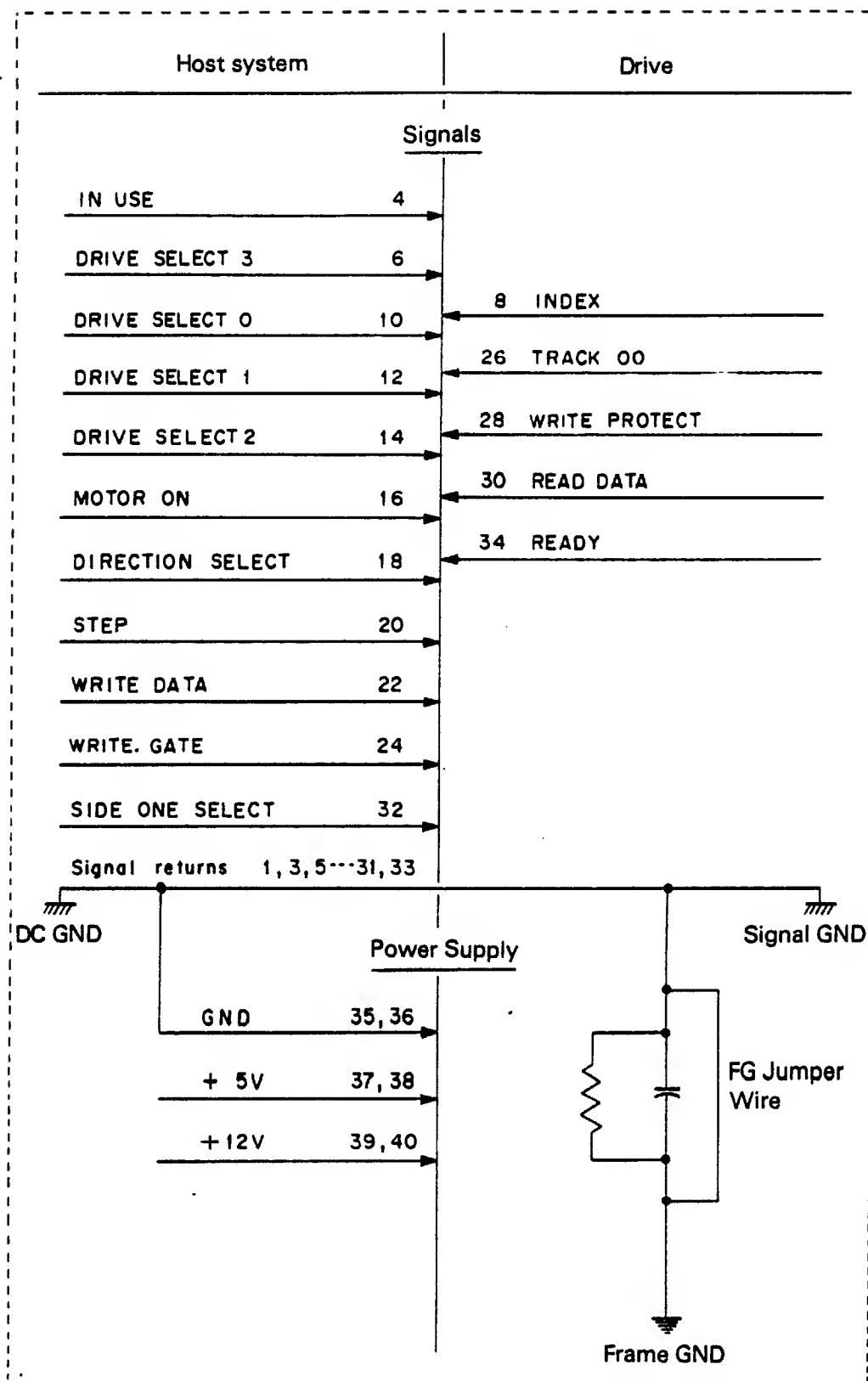
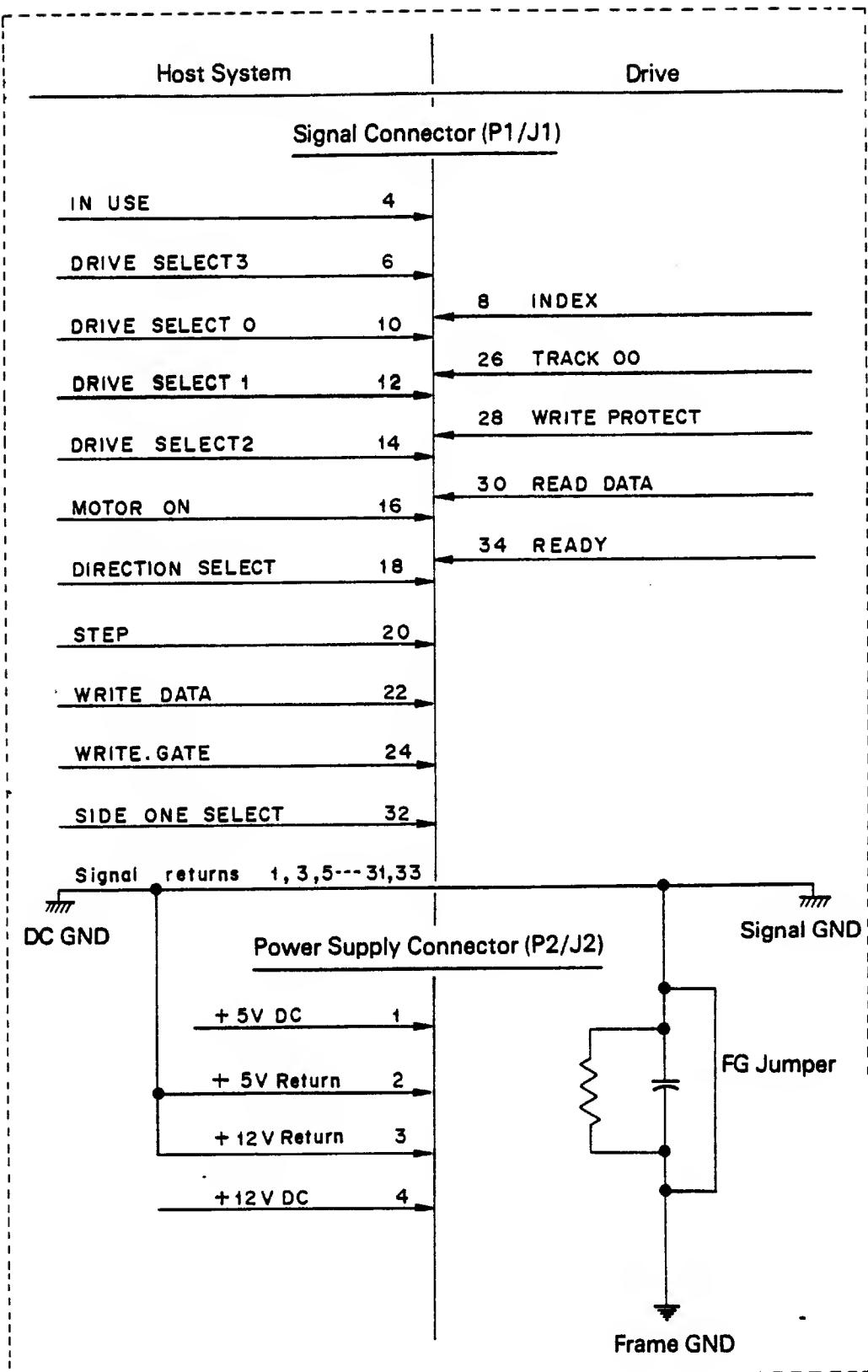


Fig. 3.9 READ DATA



**Fig. 3.10 Interface Connection**  
[Card Edge Connector]



**Fig. 3.10 Interface Connection**  
**[Pin Connector]**

### 3.1.3 Interface Circuits

The YD-600 series used 7438 NAND buffers as output line drivers, and CMOS gates as input line receivers. The input of each receiver is terminated in 1000 Ohms pulled up to +5 volts.

The illustration below shows the recommended controller interface circuit.

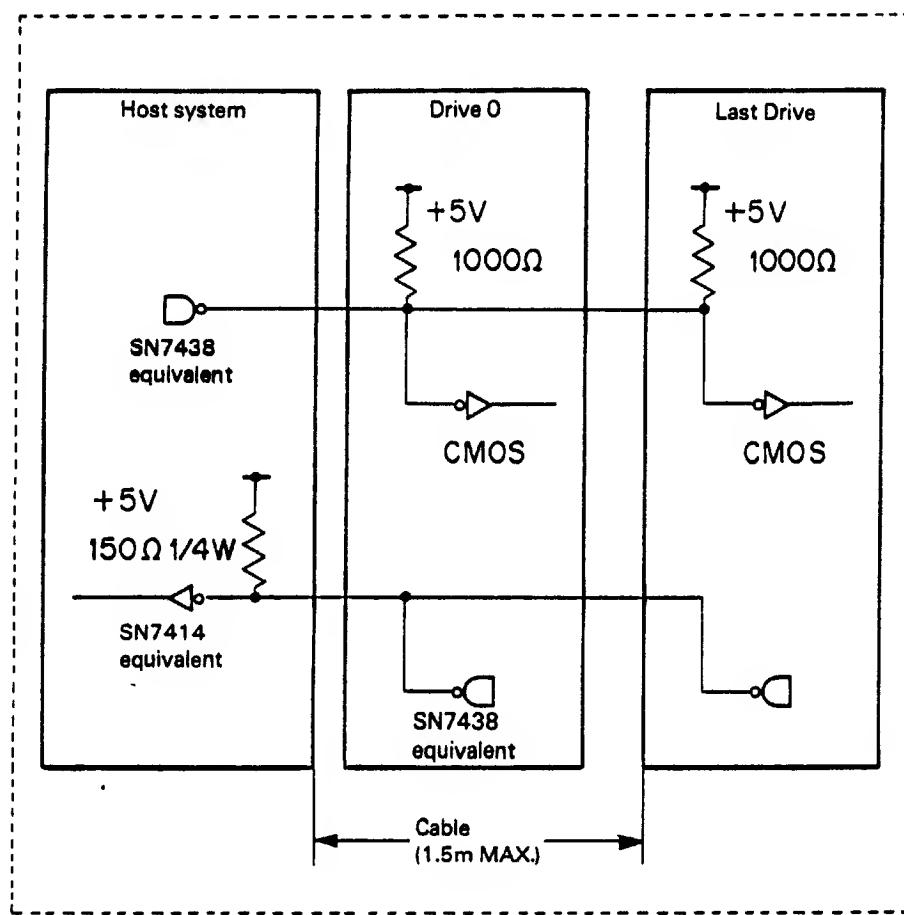


Fig. 3.11 Interface Circuit

### 3.1.4 Timing

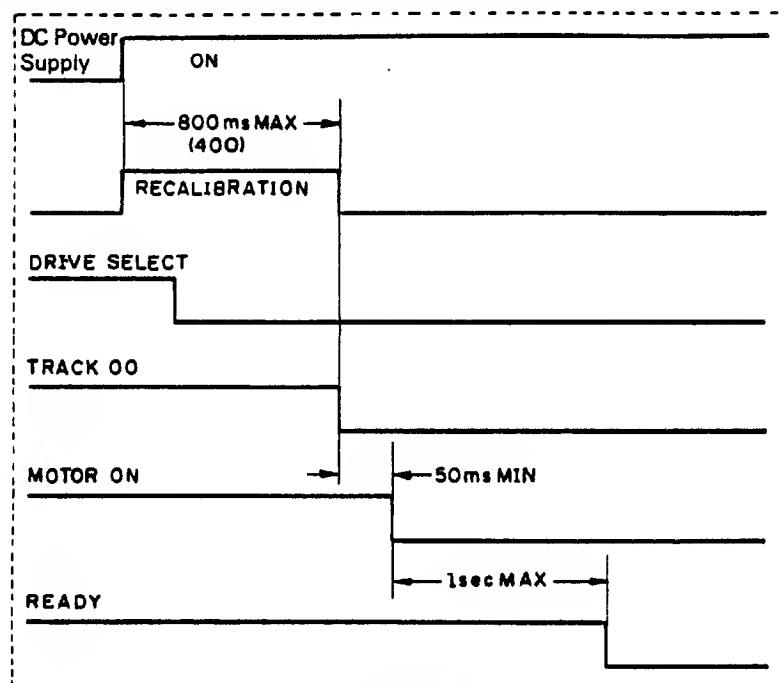
In order to keep the +12V power supply current peak as small as possible, we recommend timing motor start and the seek operation so that seek does not operate immediately after motor start. The chart below shows the preferred timing.

#### 3.1.4.1 Power Sequencing

The +5V and +12V power sources can be applied in any order. The WRITE GATE line must be turned off and kept off prior to powering the drive on or off.

### 3.1.4.2 Recalibration Timing

The drive performs recalibration after power is turned on. The MOTOR ON signal should be turned on after verifying the TRACK 00 signal (when recalibration is complete).



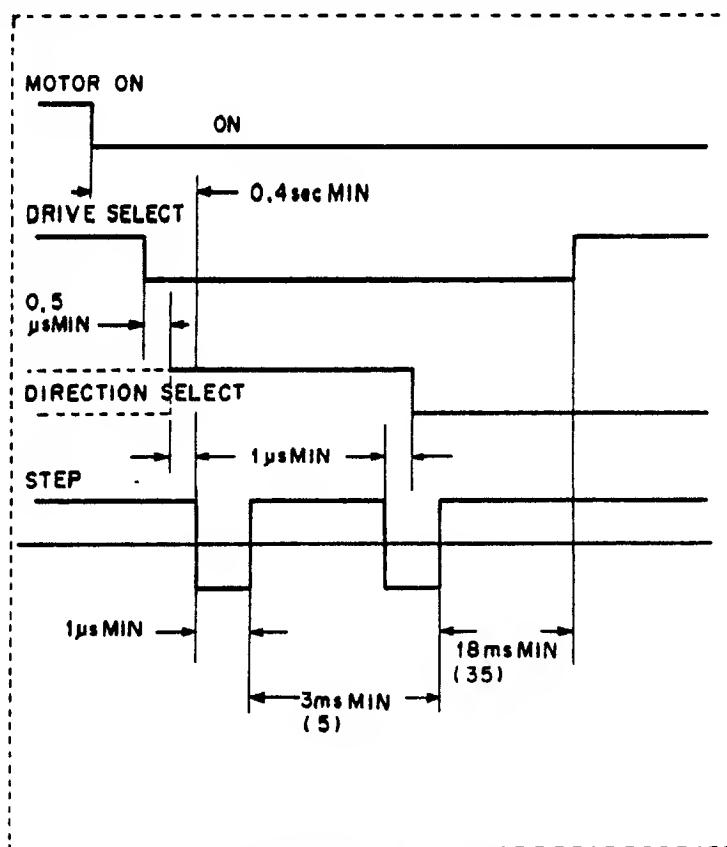
**Fig. 3.12 Recalibration Timing**

[( ) indicates value for the YD-620/YD-625]

### 3.1.4.3 Seek Timing

Seek operation can occur regardless of whether the motor is on or off.

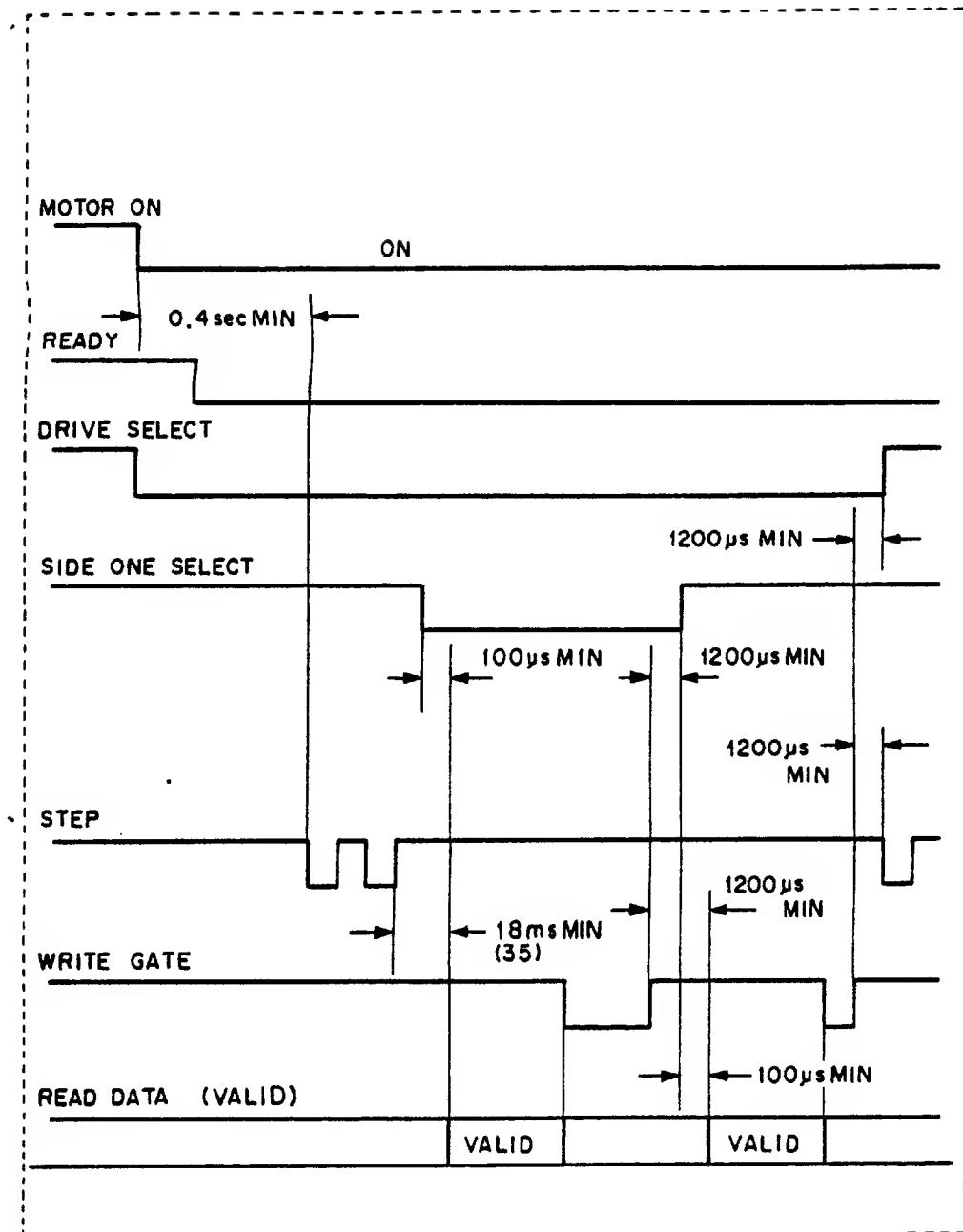
Allow a delay of 0.4 seconds after motor start before beginning the seek operation.



**Fig. 3.13 Seek Timing**

[( ) indicates value for the YD-620/YD-625]

### 3.1.4.4 Read Timing



**Fig. 3.14 Read Timing**  
[ ( ) indicates value for the YD-620/YD-625]

### 3.1.4.5 Write Timing

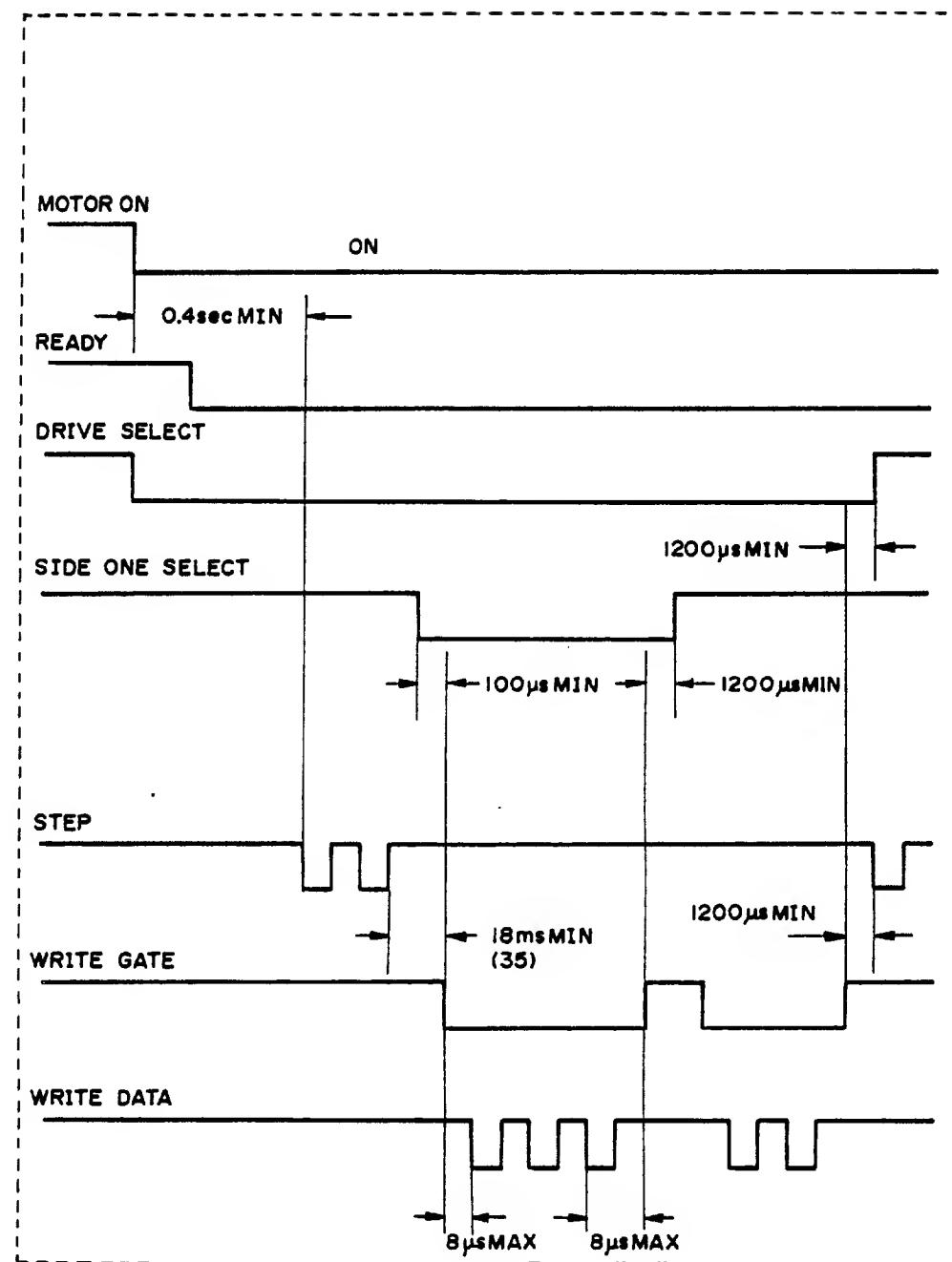


Fig. 3.15 Write Timing  
[( ) indicates value for the YD-620/YD-625]

## **3.2 Power Interface**

### **3.2.1 Power Supply Specifications**

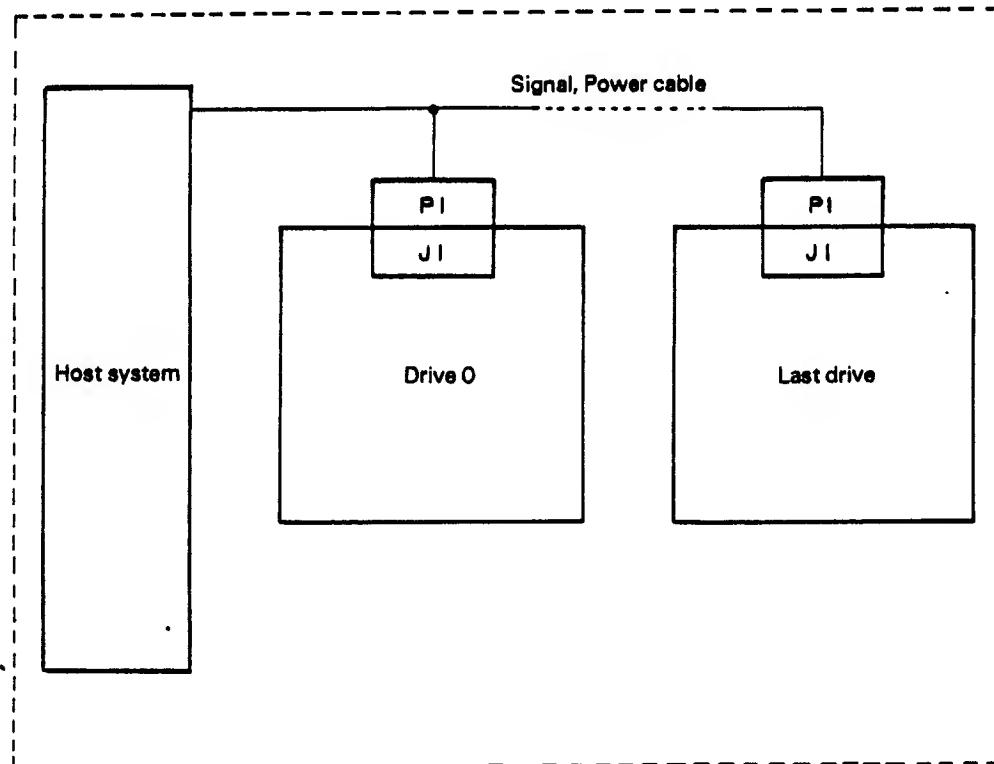
Voltage	Ripple Voltage	Current
+12 VDC ± 5%	100 mvpp Max	0.15A (TYP) 0.7A (Max)
+5VDC ± 5%	50 mvpp Max	0.24A (TYP) 0.35A (Max)

**Table 3.16 Power Supply Specifications**

**The voltages at the power connector on the PWB should match the specifications above.**

## Chapter 4A. Physical Interface

The physical interface between the drive and the host system is made through one connector (P1/J1). Pins 1 through 34 of P1/J1 are assigned to I/O signals, and pins 35 through 40 to DC power. The figure below shows the interface connections.



**Fig. 4.1 Cable Connections**  
[Card Edge Connector]

## 4.1 Connector and Cable

### 4.1.1 J1 Connector

#### 4.1.1.1 J1 Connector

J1 is a 40 pin edge connector located at the rear of the drive. The 40 pins include both signals and DC power.

The pins are numbered 1 through 40 with the even numbered pins on the component side of the PWB and the odd numbered pins on the opposite side. A key slot is provided between pins 4 and 6 to prevent misconnection.

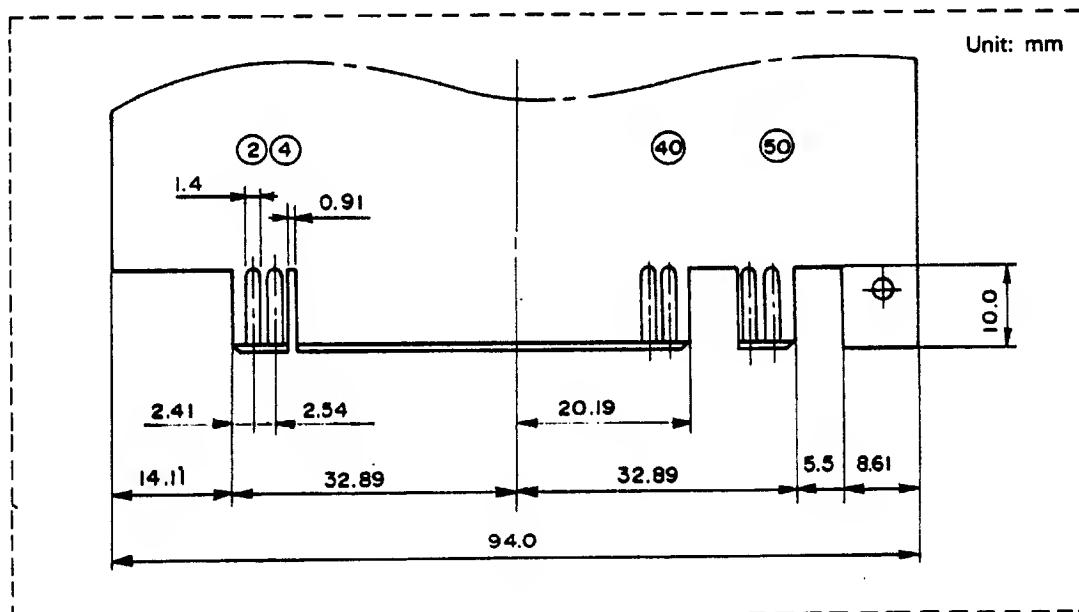


Fig. 4.2 J1 Connector Dimensions (component side)

#### 4.1.1.2 Flat Cable Connector (P1)

P1 is a mating connector on the system side which connects the card edge connector J1 to the 40 pin flat cable.

Recommended connector: 3M P/N 3464-0001  
Polarizing Key : 3M P/N 3439-0000  
Cable : 3M P/N 3365-40 (1.5m max)

[Card Edge Connector]

#### 4.1.2 Frame Ground

The drive frame is connected with the circuit ground of the PWB in order to use the frame itself as a drive shield.

In order to ground the frame at the host system:

- (1) Cut jumper (FG) on the PWB, and
- (2) Connect a grounding wire to the drive via FG tap (M3) at the rear of the drive.  
Refer to Fig. 6.3 for the location of the FG tap (M3).

### 4.2 Connector Pin Assignments

#### 4.2.1 Signal/Power Connector Pin Assignments

Return Pin #	Signal Pin #	Signal
1	2	Reserved (*)
3	4	IN USE
5	6	DRIVE SELECT 3
7	8	INDEX
9	10	DRIVE SELECT 0
11	12	DRIVE SELECT 1
13	14	DRIVE SELECT 2
15	16	MOTOR ON
17	18	DIRECTION SELECT
19	20	STEP
21	22	WRITE DATA
23	24	WRITE GATE
25	26	TRACK 00
27	28	WRITE PROTECT
29	30	READ DATA
31	32	SIDE ONE SELECT
33	34	READY
	35, 36	GND
	37, 38	+5V
	39, 40	+12V

Table 4.3 Signal/Power Connector Pins

(\*) Must be kept open at host system.

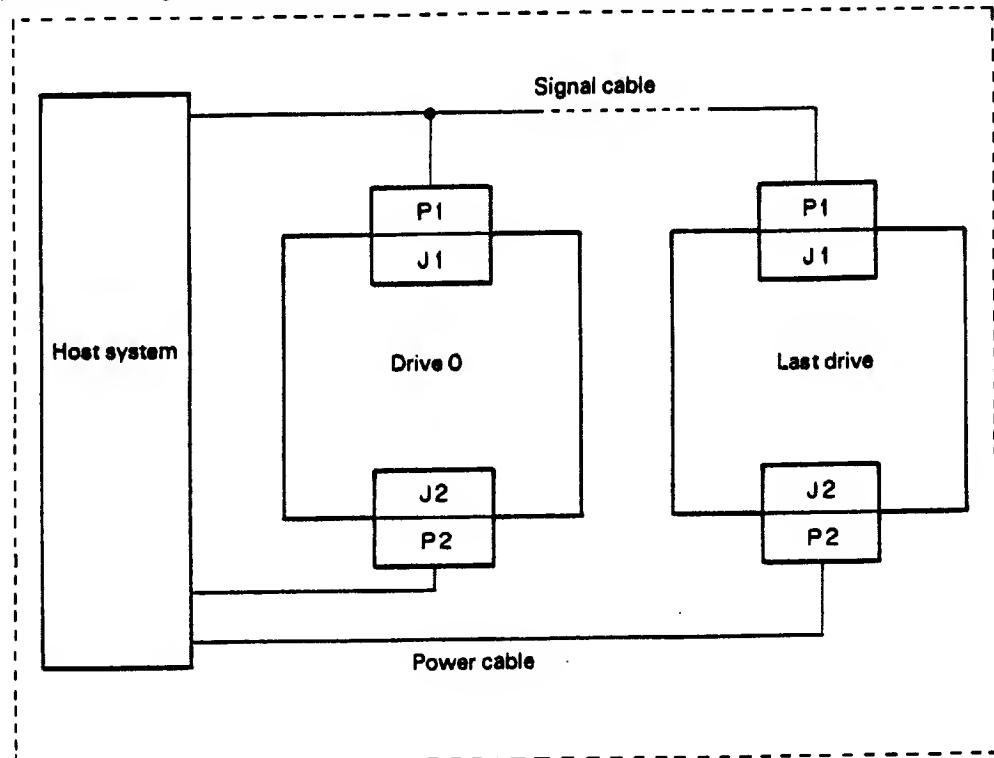
[Card Edge Connector]

### 4.3 Terminators

In a daisy chain, resistance for each line is 1000 ohms with one drive, 500 ohms with two drives and 250 ohms with four drives.

## Chapter 4B. Physical Interface

The connection with the host system is made with two connectors, signal connector P1/J1 and power connector P2/J2. The diagram below shows the cable connections.



[Pin Connector]

### 4.1 Connector and Cable

#### 4.1.1 Signal connector and Cable (J1/P1)

##### 4.1.1.1 Connector (J1)

The J1 Connector is a 34 pin male connector (JAE: PS-34PA-D4LF1-A1) located at the rear of the drive. The pins on the component side of the PWB are the odd numbered pins, and those on the opposite side the even numbered pins.

Refer to the figure below for J1 connector dimensions.

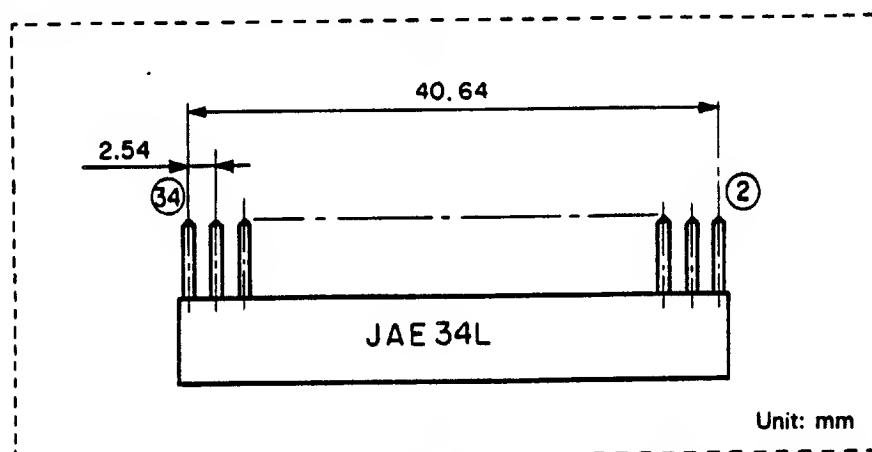


Fig. 4.2 J1 Connector Dimensions (Component Side)

#### 4.1.1.2 Flat Cable Connector (P1)

P1 is a mating connector which connects J1 and the flat cable of the host system.

Recommended Connector: JAE PS-34SEO-D4P1-1C (Closed End)

JAE PS-34SEO-D4P1-1D (Daisy Chain)

Cable: 3M 3365-34 (1.5m max)

[Pin Connector]

#### 4.1.2 DC Power Connector and Cable (J2/P2)

The J2 connector is a four pin male connector (AMP: 171826-4) located at the rear of the drive.

Recommended Components:

Receptacle (4 pin): AMP171822-4

Contact: AMP170204-2

Cable: AWG20 (1.5m Max)

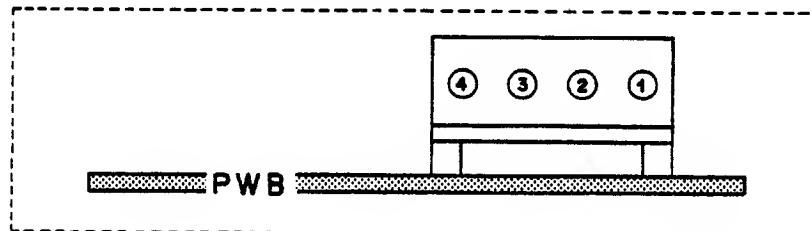


Fig. 4.3 J2 Connector Position

#### 4.1.3 Frame Ground

Refer to the section 4.1.2 on the Frame Ground in the Card Edge Connector Specifications.

[Pin Connector]

### 4.2 Connector Pin Assignments

#### 4.2.1 Signal Connector Pin Assignments

Return Pin #	Signal Pin #	Signal
1	2	reserved (*)
3	4	IN USE
5	6	DRIVE SELECT 3
7	8	INDEX
9	10	DRIVE SELECT 0
11	12	DRIVE SELECT 1
13	14	DRIVE SELECT 2
15	16	MOTOR ON
17	18	DIRECTION SELECT
19	20	STEP
21	22	WRITE DATA
23	24	WRITE GATE
25	26	TRACK 00
27	28	WRITE PROTECT
29	30	READ DATA
31	32	SIDE ONE SELECT
33	34	READY

Table 4.4 Signal Connector Pins

(\*) Must be kept open at host system.

#### **4.2.2 DC Power Connector Pin Assignments**

Pin #	Power Supply
1	+5V DC
2	+5V RETURN
3	+12V RETURN
4	+12V DC

Table 4.5 Power Supply Connector pins

#### **4.3 Terminators**

In a daisy chain, resistance for each line is 1000 ohms with one drive, 500 ohms with two drives and 250 ohms with four drives.

Refer to Fig. 3.12.

[Pin Connector]

# **Chapter 5. Installation**

## **5.1 Mechanical Dimensions**

- (1) Refer to Fig. 6.1.
- (2) The standard color for the front is as follows:
  - (a) Front Panel: Black (Munsell N1.5 equivalent)
  - (b) Push Button: Black (Munsell N1.5 equivalent)

## **5.2 Mounting Recommendations**

- (1) Refer to Fig. 6.2.
- (2) When mounting the drive in horizontal front-loading position, make sure that the PWB is down.
- (3) If the drive is mounted at a slant, the mounting angle should not exceed 20 degrees.

## Chapter 6. DIAGRAMS

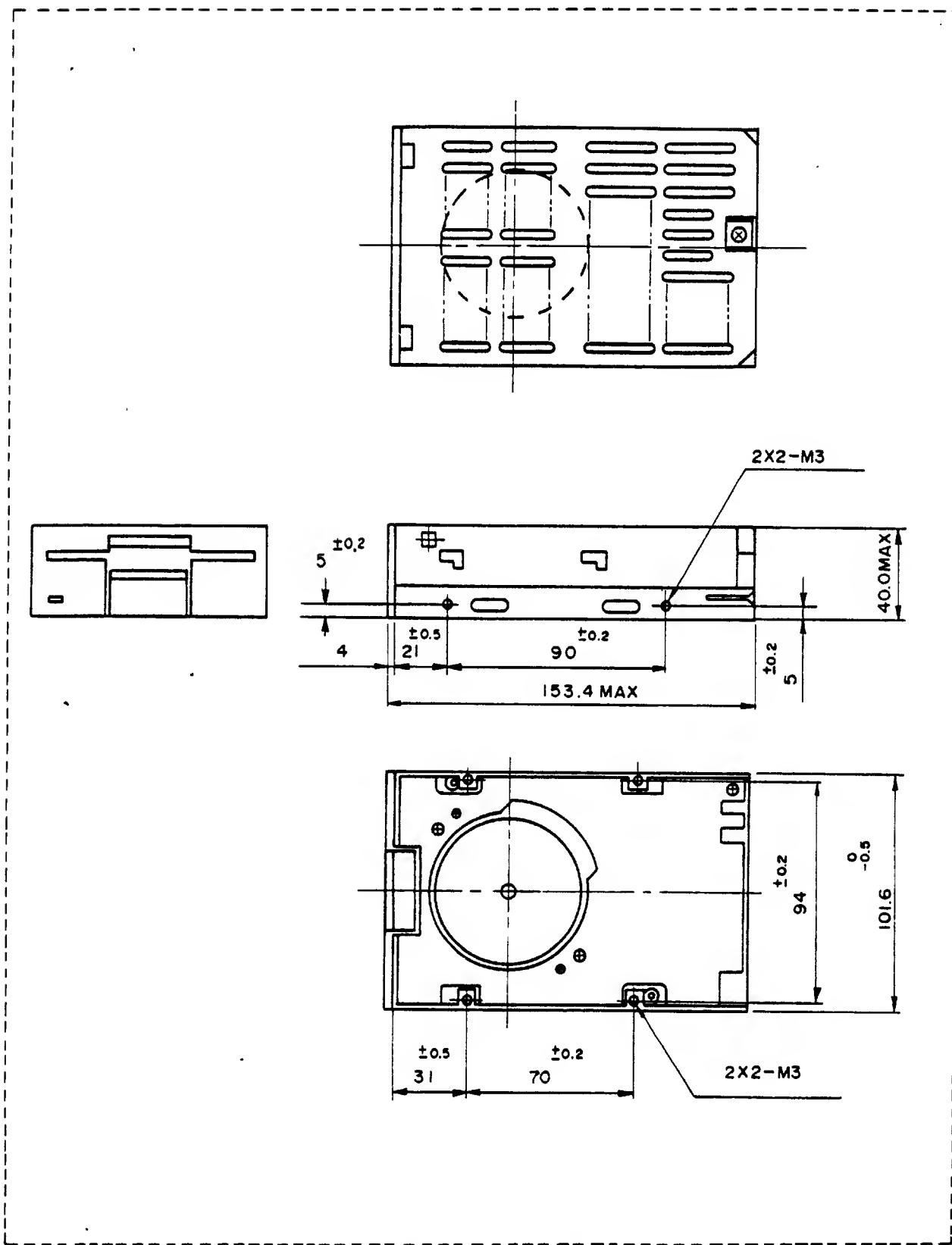
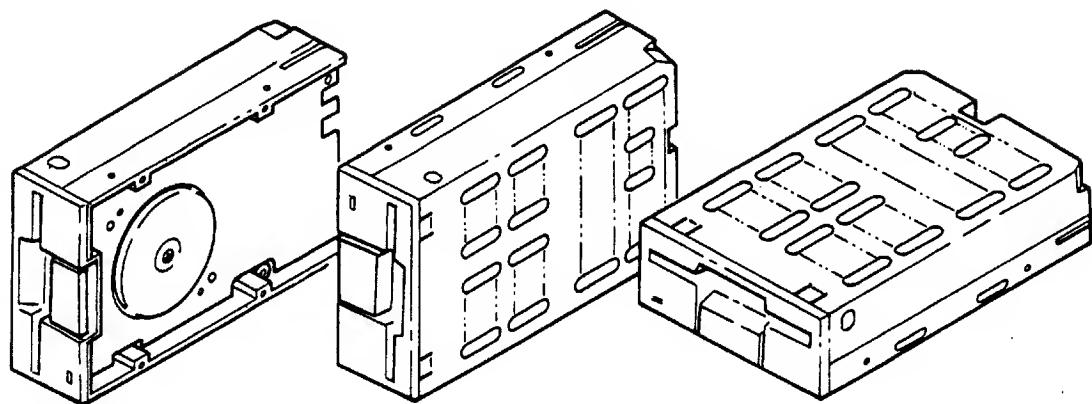
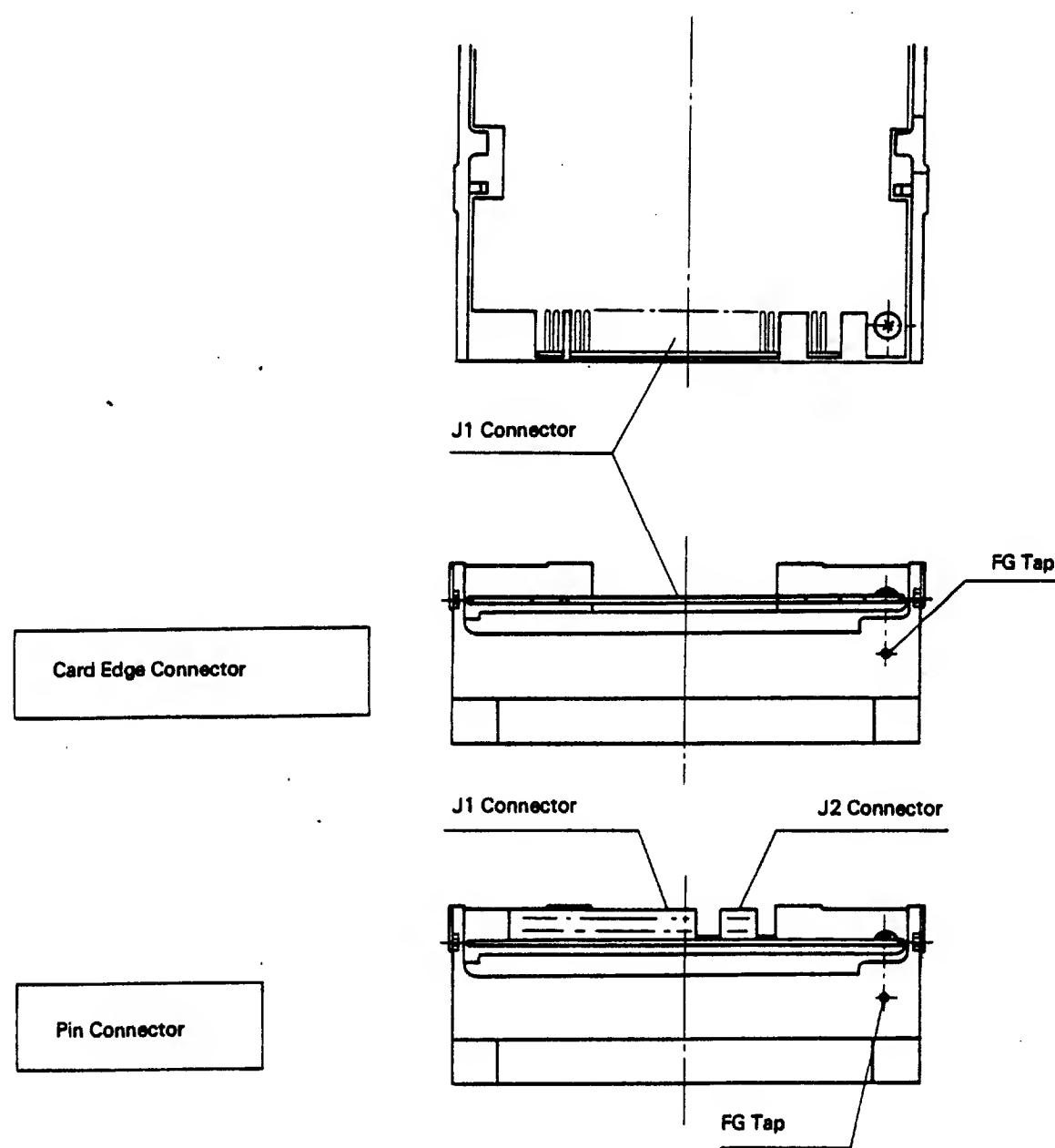


Fig. 6.1 Mechanical Dimensions



**Fig. 6.2 Recommended Mounting**



**Fig. 6.3 Connecting Points for the Frame Ground**

# **Chapter 7. Other Functional Characteristics**

## **7.1 Automatic Motor On/Off**

The drive motor is controlled as follows when power is supplied normally.

- (1) When MOTOR ON is at "Low" level.
  - (a) Inserting a disk starts the drive motor.
  - (b) Removing the disk stops the drive motor.
- (2) When MOTOR ON is at "High" level.  
The motor starts when a disk is inserted and stops a short time after insertion is completed.

## **7.2 IN USE**

The IN USE signal allows the user to control when the LED on the front bezel will light. Set the shorting plugs according to the specifications below.

### **7.2.1 Standard**

In the standard configuration, shorting plug P1 is shorted, and P2 and P3 are open.

- (1) In this configuration, the LED lights when the Drive Select signal goes "Low" when the IN USE signal is "Low", and goes out when the Drive Select signal goes "High".
- (2) When the IN USE signal is "High", the lamp will not come on regardless of the DRIVE Select signal status.

### **7.2.2 Options**

#### **7.2.2.1 Option 1**

In option 1, P2 is shorted and P1 and P3 are open.

- (1) When the IN USE signal goes "Low", the LED lights regardless of the DRIVE SELECT signal status.
- (2) When the IN USE signal is "High", the LED lights when the DRIVE SELECT signal goes "Low", and goes out when "High".

#### **7.2.2.2 Option 2**

In this option, P1 is open and P2 and P3 are shorted.

- (1) When the IN USE signal is "Low", the drive latches the leading edge of the DRIVE SELECT signal to light the drive IN USE indicator. The indicator remains lit even after the DRIVE SELECT signal turns off.
- (2) When the IN USE signal is "High", the leading edge of the DRIVE SELECT signal releases the latch to turn off the drive IN USE indicator. In this case the DRIVE SELECT signal does not turn on the indicator.